Audit Report

ACQUISITION MANAGEMENT OF THE
COMANCHE PROGRAM

Report No. 99-021 November 4, 1998

Office of the Inspector General
Department of Defense

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Acronyms

EOC	Early Operational Capability
FCR	Fire Control Radar
COEA	Cost and Operational Effectiveness Analysis

INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
400 ARMY NAVY DRIVE
ARLINGTON, VIRGINIA 22202

November 4, 1998

MEMORANDUM FOR AUDITOR GENERAL, DEPARTMENT OF THE ARMY

SUBJECT Audit Report on Acquisition Management of the Comanche Program (Report No. 99-021)

We are providing this report for your information and use This is the last in a series of three reports on the acquisition of the Comanche helicopter

The Army initiated actions to address the issues identified in this report Management comments conform to the requirements of DoD Directive 7650 3 We require no further response to the report.

We appreciate the courtesies extended to the audit staff Questions on the audit should be directed to Mr Charles M Santoni at (703) 604-9051 (DSN 664-9051) email <CSantoni@dodig osd mil> or Mr William D Van Hoose at (703) 604-9034 (DSN 664-9034) or email <WVanhoose@dodig.osd.mil> See Appendix B for the report distribution The audit team members are listed inside the back cover

Robert J Lieberman
Assistant Inspector General
for Auditing

Office of the Inspector General, DoD

Report No. 99-021 **November 4, 1998**
(Project No 7AL-0012 02)

Acquisition Management of the Comanche Program

Executive Summary

Introduction. This is the last in a series of three reports on the management of the Comanche helicopter, and it addresses issues on the acquisition strategy, fire control radar, and analysis of alternatives The two previous reports addressed the protection of the Comanche helicopter against radio frequency weapons, and financial management issues.

Audit Objective. The overall audit objective was to evaluate the management of the Comanche Program The specific objective of this segment of the audit was to evaluate the acquisition management of the Comanche Program We also reviewed the adequacy of the management control program as it applied to the specific audit objective

Audit Results. The audit identified opportunities for improvements in the acquisition management of the Comanche Program.

- The acquisition strategy of developing and manufacturing two Comanche prototypes for developmental testing and six early operational capability Comanches for user evaluation was risky and could have further delayed and increased the cost of the Comanche Program (Finding A).

- The Army planned to delay the development of a fire control radar for the Comanche until 2004. As a result, integrating a fire control radar into the Comanche could have required a major redesign that could have been unaffordable, further resulting in a Comanche without a fire control radar, which would have been less effective than the AH-64D Apache with a fire control radar (Finding B).

- The 1991 Cost and Operational Effectiveness Analysis for the Comanche helicopter was no longer valid As a result, the Army needed to revalidate that it is developing the best alternative for the Army attack and reconnaissance helicopter missions (Finding C).

To address those issues, the Program Manager for the Comanche Program proposed a revision to the acquisition strategy that would add at least one prototype for developmental testing and would eliminate the six early operational capability helicopters Also, the revised strategy would accelerate the development and integration of a fire control radar for the Comanche helicopter and update the analysis of alternatives before the Milestone II decision review We commend the Program Manager for his prompt actions See Part I for a discussion of the audit results For a discussion of the management control program, see Appendix A

Summary of Recommendations. We recommend that the Program Manager for the Comanche Program develop time-phased milestones to facilitate the completion of the agreed-upon plans of action. We also recommend that the Program Manager include updated life-cycle cost estimates, updated unit flyaway cost comparisons for the alternatives under consideration, threat scenarios contained in the latest Defense Planning Guidance, shortfalls in any performance characteristics, and the use of unmanned aerial vehicles as both an alternative and a supplement to the Comanche in the updated analysis of alternatives.

Management Comments. The Deputy for Systems Management and Horizontal Technology Integration, Office of the Assistant Secretary of the Army (Research, Development and Acquisition), stated that the Army had recognized the desirability of revising the program even before the audit. The Program Manager for the Comanche Program stated that actions that would address our concerns were in the process of being implemented and noted that his office had received approval from the Defense Acquisition Executive to restructure the existing program on July 27, 1998. See Part I for a summary of management comments and Part III for the complete text of the comments.

Audit Response. We considered the corrective actions being taken and the milestones developed for obtaining final approval and implementing the proposed revision to the strategy to be fully responsive to the recommendations. However, we question the Deputy for Systems Management and Horizontal Technology Integration's statement that the Army had recognized the desirability of revising the program prior to the audit. The entrance conference for our series of audits on the Comanche Program was held on December 10, 1996. At that time, the Comanche Program Office briefed an alternative strategy it considered to be a great innovation in the process for the development of helicopters. That alternative strategy was implemented in January 1997. Program Office officials maintained their position on the merits of the alternative strategy throughout most of the audit. On April 28, 1998, a discussion draft of this report was presented to the Program Manager questioning the alternative strategy. At that time, the Program Manager briefed the auditors on his proposed revision to the alternative acquisition strategy. Subsequently, on June 30, 1998 the Program Manager briefed the Overarching Integrated Product Team on his proposed revision. On July 27, 1998, the Defense Acquisition Executive approved initial implementation of the revised strategy and established milestones for implementing the strategy. Final approval of the revised strategy is planned for December 1998 No additional management comments are required.

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Part I - Audit Results

Audit Background

This report on the acquisition management of the Comanche Program is the last of a series of three reports on the management of the Comanche helicopter. The first report addressed the protection of the Comanche helicopter against radio frequency weapons. The second report addressed financial management issues

In April 1991, the acquisition program for the Comanche helicopter entered the program definition and risk reduction phase The program is scheduled to enter the engineering and manufacturing development phase in FY 2002 The Comanche is the first Army helicopter developed specifically for armed reconnaissance missions and will expand the Army capability to conduct reconnaissance operations in all battlefield environments The Comanche will replace three helicopters (AH-1, OH-58, and OH-6) that currently perform the armed reconnaissance mission. The Army plans to buy 1,292 Comanches, with fielding to begin in 2006. One-third of the Comanches will be equipped with a fire control radar (FCR) similar to the Longbow FCR installed on the AH-64D Apache helicopter.

The Program Manager for the Comanche, under the Program Executive Officer for Aviation, manages the Comanche Program. The contractor for the Comanche is the Boeing Sikorsky RAH-66 Comanche Team (Contractor) The Army spent $3.6 billion in research, development, test and evaluation funds through FY 1997, and plans to spend an additional $4.3 billion through FY 2009

Audit Objective

The overall audit objective was to evaluate the management of the Comanche Program. The specific objective of this segment of the audit was to evaluate the acquisition management of the Comanche Program. We also reviewed the adequacy of the management control program as it applied to the specific audit objective. See Appendix A for a discussion of the audit scope and methodology, the organizations visited or contracted during the audit, the review of the management control program, and prior audit coverage.

Finding A. Acquisition Strategy

The Comanche Program Office's acquisition strategy at the time of the audit might not have provided enough prototypes or flight hours for developmental testing; would not have provided for determining the operational effectiveness and suitability of the Comanche helicopter; and would not have provided for developing tactics, techniques, and procedures. These conditions occurred because the Comanche Program Office had not developed a rigorous analysis of the advantages and disadvantages of the acquisition strategy As a result, the Comanche Program could have been further delayed and incurred additional cost

Background

In December 1994, the Secretary of Defense directed the restructure of the Comanche Program into a technology program, which would develop and build two flyable Comanche prototypes but would defer the engineering and manufacturing development phase and the production phase.

The Comanche Program Office was against restructuring the program into an industrial- and technology-based program and began looking at alternatives. The Comanche Program Office conceived an alternative strategy that continued the development of two Comanche prototypes and added six early operational capability (EOC) Comanches for user evaluation. The two prototypes were for developmental testing and the six EOC Comanches were to be used to determine the Comanche's operational effectiveness and suitability and to develop tactics, techniques, and procedures. The alternative strategy extended the definition and risk reduction phase from FY 1996 to FY 2002 and did not require major funding until FY 1999. On March 9, 1995, the Comanche Program Office briefed the alternative acquisition strategy to the Conventional Systems Committee On March 21, 1995, the Under Secretary of Defense for Acquisition and Technology issued an Acquisition Decision Memorandum that approved an acquisition strategy of two Comanche prototypes for developmental testing and six EOC Comanches for user evaluation.

Prototypes and Flight Hours for Developmental Testing

The acquisition strategy approved in March 1995 was risky because it might not have provided sufficient Comanche prototypes or flight hours for developmental testing. The original strategy, approved in April 1991, planned for six Comanche prototypes and 2,820 flight hours for developmental testing. The strategy provided only two Comanche prototypes and 1,116 flight hours for developmental testing. As a result, sufficient developmental flight testing might not have been accomplished to demonstrate the maturity of the Comanche system for a successful Milestone II decision.

Original Strategy. The original acquisition strategy was a low-risk approach to aircraft development that provided six Comanche prototypes for developmental testing. The number of flight hours identified for test, evaluation, and demonstration of specific systems and subsystems was clearly defined The six prototypes were to provide 445 flight hours of developmental testing during the program definition and risk reduction phase and 2,375 flight hours of developmental testing during the engineering and manufacturing development phase. In addition, the propulsion system test bed was to provide 475 operating hours during the program definition and risk reduction phase and 1,100 hours during the engineering and manufacturing development phase.

Alternative Strategy. The alternative strategy approved in March 1995 provided only two Comanche prototypes for developmental testing, which was a 67-percent decrease in the number of Comanche prototypes provided under the original acquisition strategy. The two prototypes are to provide 723 flight hours of developmental testing during the program definition and risk reduction phase and 393 flight hours of developmental testing during the engineering and manufacturing development phase. This is a 60-percent decrease in the flight hours for developmental testing provided under the original strategy. In addition, the propulsion system test bed is to provide 750 operating hours for developmental testing during the program definition and risk reduction phase and none during the engineering and manufacturing development phase We were not able to identify any reason that would justify the significant decrease in the number of Comanche prototypes and flight hours for developmental testing.

The differences between the original strategy, implemented in 1991, and the alternative strategy, implemented in 1997, are shown in the following table

Comparison of the Original Strategy to the Alternative Strategy

	Original	Alternative
Quantity of prototypes	6	2
Hours of testing		
Prototype		
Program definition and risk reduction	445	723
Engineering and manufacturing development	2,375	393
Total Prototype Testing	2,820	1,116
Propulsion system test bed		
Program definition and risk reduction	475	750
Engineering and manufacturing development	1,100	0
Total propulsion system test bed	1,575	750
Total hours of testing	**4,395**	**1,866**

The Comanche Program Office stated that the same developmental testing scheduled under the original strategy would be maintained; however, we were unable to identify how the same flight test program could be conducted with a 67-percent reduction in test assets and a 60-percent reduction in flight hours for

developmental testing. Also, it is unlikely that the two Comanche prototypes will achieve 723 hours of flight testing during the program definition and risk reduction phase because a majority of the developmental testing is scheduled to be conducted with Prototype No. 1 Prototype No. 1 accumulated only 70 hours of the 145 hours of flight testing scheduled during January 1996 through March 1998, because of the technical challenges encountered in developing this complex system It will be extremely difficult to increase the number of flight hours with only Prototype No 1 available for developmental testing Also, the Comanche Program Office had not scheduled Prototype No. 2 for any significant flight testing until January 2001, just 10 months before the Milestone II decision. The loss of an aircraft during flight testing is common for developmental programs as the test envelope expands; for example, the tester of the MV-22 aircraft lost two test aircraft during developmental testing With its limited test assets, the Comanche Program cannot afford to lose a prototype during developmental testing.

Operational Effectiveness and Development of Tactics, Techniques, and Procedures

The EOC Comanches may not be sufficiently developed to determine the operational effectiveness and suitability of the Comanche or to develop tactics, techniques and procedures The primary mission of the Comanche will be armed reconnaissance operations; however, the EOC Comanches will not have full reconnaissance and attack capability in the areas of mission planning, stealth, enemy detection, communications, and the capability to fight for information The EOC Comanches may also not have full performance capabilities The EOC Comanche would be more mature than the current prototypes but less mature than low-rate-initial-production Comanches.

Mission Planning. The EOC Comanches will not have a tactics expert function to generate a flight route from an aircraft's position to the next point of flight This capability ensures that the aircraft's track remains outside any known threat engagement range or reaction time for single threats, and maximizes aircraft survivability for multiple threats For targets designated for attack, the tactics expert function identifies a firing position that provides the greatest field of regard and the lowest possibility of exposure to the attacking aircraft The tactics expert function considers the mission objectives, friendly and enemy tactics, order of battle, as well as target characteristics when making route, position, or tactics recommendations. These capabilities are important in determining the operating effectiveness and suitability of the Comanche in an advanced warfighting exercise and for developing tactics, techniques and procedures.

Stealth. A successful reconnaissance operation may require entering an area undetected, obtaining intelligence information, and returning undetected The Comanche is being designed to have a small radar cross section and low infrared signature to make detection difficult. The Comanche will not be fully capable in those areas until the low-rate initial production Comanche. If tactics, techniques, and procedures are developed based on Comanches with partial capability, they will have to be redeveloped using Comanches with full capability. If field exercises for developing tactics, techniques, and procedures involve simulating a greater capability than the Comanche actually has, other aircraft, such as the Kiowa Warrior or the Apache, could be used to simulate a Comanche

Enemy Detection. The EOC Comanches will not be fully capable of alerting the crew of enemy detection, although a successful reconnaissance and attack mission could depend upon the Comanche crew being aware of enemy detection. The Comanche warning system to alert the crew if radar or infrared sources illuminate the helicopter will not be fully capable on the EOC Comanches. In addition, low-rate initial production Comanches will have a radio frequency interferometer to locate sources of radio frequency emissions This equipment is important for the survivability of the Comanche during reconnaissance missions; however, the EOC Comanche will not even have a radio frequency interferometer with partial capability

Communications. The EOC Comanches will not be fully capable of communicating with intelligence and reconnaissance assets of other Services. Communication will be accomplished with the Link-16; however, the Link-16 will not be installed on the EOC Comanches. Also, EOC Comanches will not have high frequency communications, which provide non-line-of-sight tactical communications with anti-jam capability They will also have a limited capability for digital data messages and imagery, and integrated communications, navigation, and identification avionics.

Fight for Information. The EOC Comanches will not have the capability to demonstrate that they can fight for information. The EOC Comanches will not have any weapon system installed, the target acquisition systems will have only a partial capability, and the EOC Comanche will not have an electro-optical countermeasures capability

Performance Capability. The EOC Comanches may not have full performance capability The Contractor is not required to meet the speed and rate-of-climb requirements for the EOC Comanches; therefore, there is no assurance that the EOC Comanches will perform at the same level as the production Comanches. Also, the T801 engine configuration and electronic control unit software that contain many improvements that were to be included on the EOC Comanches will not be available. As a result, the EOC aircraft will operate in a restrictive flight mode.

The test and evaluation master plan for the Comanche states that the EOC Comanches will be used to determine the operational effectiveness and suitability of the Comanche. Also, representatives of the System Manager Comanche, Army Training and Doctrine Command, stated that they will use the EOC Comanches to develop tactics, techniques, and procedures based on the characteristics of the aircraft. The EOC Comanches are not scheduled to have full reconnaissance capability, therefore, they will not have the maturity to determine the operational effectiveness and suitability of a production representative Comanche or to develop tactics, techniques, and procedures

Development of the Acquisition Strategy

The Comanche Program Office did not develop a rigorous analysis of the advantages and disadvantages of its selected acquisition strategy of two prototypes for developmental testing and six EOC Comanches for user evaluation. The Comanche Program Office's objective in developing the acquisition strategy was to propose an alternative program that would result in the eventual production of the Comanche Selling points for the alternative acquisition strategy were the six EOC Comanches for user evaluation early on in the program and extending the program so that large blocks of funding would not be needed before FY 1999. This acquisition strategy kept the Comanche Program on a track leading toward production, however, it is risky because not enough Comanche prototypes or flight hours are available for developmental testing Also, the EOC Comanches will not determine the operational effectiveness and suitability of a production representative Comanche or develop tactics, techniques, and procedures.

Revisions to the Acquisition Strategy

The Comanche Program Office should consider revising its acquisition strategy to reduce the risk of cost and schedule overruns and to enter production on schedule. One such revision would be to eliminate the six EOC Comanches and increase the number of prototype aircraft and flight hours for developmental testing Because little will be gained from using the EOC Comanches to determine the operational effectiveness and suitability of the Comanche and to develop tactics, techniques, and procedures, little will be lost by canceling the EOC portion of the acquisition strategy Funds that would be used to manufacture, operate, and support the six EOC Comanches would become available for additional prototypes, flight hours for developmental testing, and for tasks directly related to maturing the Comanche systems The additional funds would increase the probability of a successful Milestone II decision without having to defer capabilities to the engineering and manufacturing development phase and would keep the Comanche on track for a production decision in 2004 Also, depending on the number of EOC Comanches that would be converted to prototypes, additional funds could be used for tasks deferred to the next phase of the program, such as the fire control radar.

Summary

The acquisition strategy at the time of the audit might not have provided sufficient Comanche prototypes or flight hours for developmental testing. The original program planned for six prototypes to provide 2,820 hours of developmental testing during acquisition Phases I and II. The Comanche Program, as restructured in January 1997, planned for two prototypes to provide 1,116 hours of developmental testing during acquisition Phases I and II As a result, the Comanche Program Office might not have had an adequate quantity of prototypes or sufficient flight test hours to accomplish acquisition Phases I and II to ensure that the required system maturity is achieved by the Milestone II decision. Also, the EOC Comanches might have lacked the needed maturity for determining the operational effectiveness and suitability of the production Comanche and for the development of tactics, techniques, and procedures. Therefore, we concluded that revisions needed to be considered that included the elimination of the six EOC Comanches for user evaluation and development of tactics, techniques, and procedures. Those revisions would increase the number of prototype Comanches and provide additional fight hours for developmental testing.

Management Action

The Program Manager for the Comanche Program generally agreed that additional Comanche prototypes were needed for developmental testing and that the six EOC Comanches would not be entirely suitable for user evaluation. To correct this condition, the Program Manager proposed a revision to the Comanche program that would add at least one Comanche prototype for developmental testing. The revision would also eliminate the six EOC Comanches. Users would be provided production representative Comanches for evaluation of the operational suitability and effectiveness and for development of tactics, techniques, and procedures These actions, when implemented, would correct the problems identified in this finding. However, the Comanche Program Office had not yet developed time-phased milestones for implementing the plan of action.

Recommendation and Management Comments

A. We recommend that the Program Manager for the Comanche Program, under the Program Executive Officer for Aviation, Department of the Army, develop time-phased milestones for obtaining approval and implementing proposed revisions to the Comanche acquisition strategy.

Management Comments. The Army concurred with the recommendation and stated that the transition to the revised acquisition strategy should resolve the finding. The Army provided the following milestones for implementing the revised strategy. submittal of an updated Acquisition Strategy Report, Acquisition Program Baseline, and Test and Evaluation Master Plan (September 1998), initial review of the cost by the Cost Analysis Improvement Group and the Cost and Economic Analysis Center (October 1998), evaluation of the cost review results by the Overarching Integrated Product Team prior to recommending Defense Acquisition Executive approval of the revised strategy (December 1998), and implementation of the revised strategy (December 1998) The full text of the Army comments is in Part III

Finding B. Fire Control Radar

The Comanche Program Office planned to delay the development of a fire control radar (FCR) for the Comanche until 2004 This condition occurred because the Comanche Program Office assigned a higher priority to other tasks, which then received the available funds. As a result, integrating an FCR into the production configuration of the Comanche could have required a major redesign that could be unaffordable, further resulting in a Comanche without an FCR, which would be less effective than the Apache with an FCR

Background

The FCR is a mast mounted, millimeter wave radar system for the detection, classification, prioritization, and targeting of threat systems. The FCR classifies targets as tracked vehicles, wheeled vehicles, air defense systems, helicopters and fixed wing aircraft Originally, the Army developed the FCR for firing Longbow Hellfire missiles from the AH-64D Apache helicopter Early in the Comanche Program, based at least in part on the results of the 1991 Cost and Operational Effectiveness Analysis (COEA), the Army decided that an FCR similar to the one installed on the AH-64D Apache should be developed for the Comanche helicopter The 1991 COEA showed that the Comanche without a fire control radar was the third choice for Army reconnaissance and attack missions. The results of that analysis showed that the Comanche with an FCR was the best alternative, the AH-64D Apache with an FCR was the second alternative, and the Comanche without an FCR was the third choice.

The Comanche Program Office implemented an alternative development schedule in January 1997 as a result of a restructure of the Comanche program, which delayed the start of the development and integration of an FCR for the Comanche until 2004 As of April 9, 1998, the Comanche Program office did not plan to begin developing an FCR for the Comanche until 2004

Development and Integration of the Fire Control Radar

The Comanche Program Office decision to delay the development and integration of an FCR could result in a Comanche without an FCR. This situation may occur because integrating an FCR into the production configuration of the Comanche could require a major redesign of the Comanche that could be unaffordable Designing the total Comanche system to include the FCR concurrently would be less costly than modifying the Comanche later to accommodate an FCR The integration of the FCR will most likely affect the aerodynamic design, weight, software, and low observable characteristics of the Comanche

Aerodynamic Design. Delay in identifying the effects of the FCR integration on the aerodynamic design of the Comanche could have a negative impact on the Comanche Program. The Contractor identified an aerodynamic design problem during flight testing of the first Comanche prototype The Contractor believes that turbulent air coming from the main rotor is causing a vibration of the tail section of the helicopter As of April 15, 1998, both the Comanche Program Office and the Contractor were working on a solution to that problem; however, a long-term solution may be costly. The integration of the FCR into the Comanche will affect its aerodynamic design because the FCR will be mounted on the mast of the Comanche above the main rotor and could affect air flow. Therefore, the Contractor's solution to the tail vibration problem should be determined giving consideration to the effects of integrating the FCR

Weight. Delaying the identification of the effects of the FCR weight could have a negative impact on the Comanche Program The integration of the FCR into the Comanche will affect its weight The Contractor is having problems in designing the Comanche to meet its weight requirements, and increases in weight will affect the performance of the Comanche. As of the October 28, 1997, Integrated Baseline Review, the empty weight of the Comanche was 8,855 pounds, only 88 pounds below the maximum empty weight for low-rate initial production of 8,943 pounds. The Comanche Program Office has allocated 350 pounds of additional weight for the FCR. If the FCR for the Comanche cannot be designed to be within the 350 pound allocation, modification to the Comanche may be required or its performance would be degraded.

Software. Delaying the identification of the interfaces between the FCR computer software and the mission computer software could be costly. The FCR will interface with various modules of the mission computer of the Comanche. Designing and developing the computer software for the mission computer and the FCR concurrently may be less costly. The development and integration of software is particularly important and should be initiated as soon as possible, because software development is designated as a high-risk area for the Comanche Program.

Low-Observable Characteristics. Delay in identifying the effects of the FCR integration on the low-observable characteristics of the Comanche could have a negative impact on the Comanche Program. The Comanche is required, and is being designed, to be stealthy. The Comanche Program Office estimates that the integration of the FCR will significantly increase the radar cross-section of the Comanche. The impact of the increased radar cross-section will not be fully known until the FCR is developed and integrated into the Comanche. The impact of the FCR on mission performance where stealth is required should be determined as the design of the Comanche is being completed.

Development Priorities

The Comanche Program Office did not give the development and integration of the FCR a high enough funding priority for available funds As a result, the task was delayed until 2004 and subsequent years We question the priorities established by the Comanche Program Office. For example, the Comanche Program Office scheduled the manufacturing of the EOC Comanches to start in 1998 As discussed in Finding A, the task of manufacturing the EOC Comanches and giving them to the user for evaluation is questionable. The elimination of the EOC portion of the Comanche Program would provide funds to accelerate the start of the development and integration of the FCR for the Comanche

Summary

The Comanche Program Office's plan to delay the development of the FCR for the Comanche helicopter until 2004 needs to be changed The decision to delay the development and integration of the FCR could result in a Comanche without an FCR. The Comanche Program Office should be able to better manage the impacts of the FCR on aerodynamics, weight, software, and low-observable characteristics during the design of the total Comanche system. If the Comanche Program Office waits to integrate the FCR into the Comanche until after the production version is completed, the integration could be technically difficult and possibly unaffordable.

Management Action

The Program Manager for the Comanche Program agreed that the development and integration of an FCR for the Comanche should be accelerated, and indicated that he would initiate plans to correct the conditions identified in this finding. However, the Comanche Program Office did not develop time-phased milestones for implementing the acceleration of the development and integration of the FCR for the Comanche.

Recommendation and Management Comments

B. We recommend that the Program Manager for the Comanche Program, under the Program Executive Officer for Aviation, Department of the Army, develop time-phased milestones for accelerating the development and integration of a fire control radar for the Comanche.

Management Comments. The Army concurred with the recommendation and stated that on July 27, 1998, the Comanche Program Office received approval from the Defense Acquisition Executive to restructure the existing program. The Army further stated that a key element of the restructure is to accelerate

development, integration and testing of the fire control radar to match the current development plan for the basic aircraft. The Army provided milestones for the final approval and implementation of the restructure. The full text of the Army comments is in Part III.

Finding C. Analysis of Alternatives

The 1991 Cost and Operational Effectiveness Analysis (COEA) for the Comanche helicopter was no longer valid because of changes to the procurement quantities, costs, threats, capabilities, and alternatives for the Comanche helicopter since it was prepared As a result, the Army needed to revalidate that it is developing the best alternative for the Army attack and reconnaissance helicopter missions

Regulations

DoD Regulation 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs," March 15, 1996, states that an analysis of alternatives shall be prepared and considered at appropriate milestone decision reviews of Acquisition Category I programs, beginning with program initiation (usually Milestone 1) This analysis was commonly referred to as a COEA in prior regulatory guidance The DoD Regulation 5000.2-R states that the Milestone Decision Authority may direct updates to the analysis for subsequent decision points, if conditions warrant. For example, the analysis of alternatives may be useful in examining cost performance trades at Milestone II

Factors That Affect the Analysis of Alternatives

Factors that have changed since 1991 for the Comanche invalidate the results of the 1991 COEA. Those factors include procurement quantities, costs, threats, capabilities, and alternatives

Procurement Quantities and Costs. The quantity of Comanches to be procured, as well as the total cost of the Comanche Program, has changed dramatically since the completion of the 1991 COEA Although the original program objective was for 2,096 Comanches, changing perceptions of future threats to the United States resulted in reductions to the Army force structure The 1991 COEA used a proposed buy of 2,096 Comanches as the basis for a comparative analysis in the cost area The Army also conducted sensitivity analyses in the cost portion of the COEA to address a potential reduced buy of 1,292 Comanches and the impact of that reduction on total cost and average unit flyaway cost. Based upon the data available at the time, the COEA concluded that the Comanche was still the most cost- and operationally effective alternative to the Army's light helicopter requirement.

The actual life-cycle cost of the Comanche, in FY 1996 dollars, grew from $62.9 billion in 1991 to $101 3 billion in 1996, an increase of $38 4 billion or 61 percent In addition, the projected quantity of Comanches to be procured

declined from 2,096 to 1,292, a decrease of 804 or 38 percent. Additionally, the Comanche unit flyaway cost, in FY 1997 dollars, grew from $9 6 million in 1988, which was used in the 1991 COEA, to $14.9 million in 1997, a 55 2-percent increase.

Threats. The world situation upon which the COEA determined the operational effectiveness of the Comanche has changed significantly The COEA examined company through corps-level attack and armed reconnaissance aviation missions in European, Southwest Asian, and Latin American scenarios The timeframe for the COEA analysis was 1996 through 2004.

The primary change to the threat that the Comanche may encounter is the decline of the former Soviet Union. The Army used the European scenario, based upon a massive Soviet-sponsored Warsaw Pact invasion of Western Europe, as a primary means of justifying the Comanche. The threat of a massive Soviet-backed invasion of Western Europe has greatly diminished, and the timeframe upon which the analysis was based will be outdated before the first Comanche is fielded

Capabilities. The performance requirements portrayed in the 1991 COEA may not be achievable due to the potential excessive weight of the Comanche As of the October 28, 1997, integrated baseline review, the empty weight of the Comanche was 8,855 pounds, only 88 pounds below the maximum empty weight of 8,943 pounds for low-rate initial production Comanche The Comanche Program does not have a weight management reserve to accommodate unexpected weight growth Although the Contractor assigned a weight reduction target to each subsystem to achieve the target weight, some subsystems have actually increased in weight as the designs have matured Examples include the electro-optical system and the secondary power unit. For other subsystems such as engines, further weight reductions, if technically feasible, will be expensive For other components, such as the drive train and air frame, reduced weight may compromise their reliability Failure to achieve and maintain target weight as the aircraft transitions from low-rate initial production to full-rate production will adversely affect required performance characteristics Even if the low-rate initial production weight goal is achieved, managing the balance between weight growth and performance characteristics will be challenging The Contractor estimates that the loaded weight of the Comanche will grow by at least 433 pounds during the transition. Typical consequences of weight growth during development or production are the loss of design payload and reduced flight performance. For example, the additional 433 pounds will cause a decrease in the vertical rate of climb for Comanches equipped with the FCR of 350 feet per minute over Comanches without the FCR.

The loss of design payload or reduced flight performance requires either an increase in power or an increase in rotor size and blade length. At present, the T800 engine that was initially developed for the Comanche has already been stretched to its near-term limit to accommodate known weight problems The T801 engine may not be able to accommodate additional potential weight growth Any increase in engine size will result in additional weight and increased fuel consumption and could adversely impact the Comanche's ability to remain on

station. Increased fuel consumption could require external fuel tanks or a reduction in the internal payload, thereby adversely affecting the radar cross-section or the mission capability of the aircraft. An increase in rotor size and blade length could compensate for a deterioration in flight characteristics; however, they add weight and could also adversely impact the aircraft radar cross-section

Alternatives. The Milestone I Acquisition Decision Memorandum dated March 21, 1995, requires the Army to develop COEA guidance to support the Milestone II decision, currently scheduled for October 2001, including analysis of the combined effect of trade-offs between reconnaissance helicopters and the unmanned aerial vehicle The Army tested its unmanned aerial vehicle at the national training center in March 1997, with promising results. The unmanned aerial vehicle was able to fly in extremely heavy wind, even when rotary wing aircraft were grounded It also demonstrated potential as a dynamic and responsive sensor available to the ground commander. The unmanned aerial vehicle regularly provided first round fire for effect accuracy and provided precision targeting and security for attacking helicopters.

Summary

The Comanche's COEA has not been updated since it was prepared in 1991 The Army should take into account the factors that have changed since then. The changing factors include procurement quantities, costs, threats, capabilities, and alternatives that could significantly alter the results of the 1991 COEA The Milestone II analysis of alternatives should include these factors to ensure that the Army can develop the Comanche to meet its requirements for an attack and reconnaissance helicopter

Management Action

The Program Manager for the Comanche Program informally agreed to update the information contained in the FY 1991 COEA by directing an analysis of alternatives to be prepared before the Milestone II review. The analysis of alternatives will include updated life-cycle cost estimates, updated unit flyaway cost comparisons for the alternatives under consideration, threat scenarios contained in the latest Defense Planning Guidance, shortfalls in any performance characteristics, and the use of the unmanned aerial vehicle as both an alternative and as a supplement to the Comanche. These actions would correct the conditions identified in this finding; however, the Comanche Program Office had not yet developed time-phased milestones for preparing the analysis of alternatives

Recommendations and Management Comments

C. We recommend that the Program Manager for the Comanche Program, under the Program Executive Officer for Aviation, Department of the Army:

1. Include updated life-cycle cost estimates, updated unit flyaway cost comparisons for the alternatives under consideration, threat scenarios contained in the latest Defense Planning Guidance, shortfalls in any performance characteristics, and the use of the unmanned aerial vehicles as both an alternative and a supplement to the Comanche in its analysis of alternatives for Milestone II.

2. Develop time-phased milestones for preparing its analysis of alternatives.

Management Comments. The Program Manager for the Comanche Program stated that the recommended changes will be implemented to support the Milestone II decision. The full text of the Army comments is in Part III.

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Part II - Additional Information

Appendix A. Audit Process

Scope

Work Performed. We evaluated the acquisition management of the Comanche Program and included a review of the current acquisition strategy to determine whether it provided sufficient prototypes and flight hours for developmental testing. We reviewed the early operational capability concept to determine whether the objectives were likely to be achieved In addition, we reviewed the schedule for the development and integration of a fire control radar for the Comanche to determine the risks involved. Finally, we reviewed the 1991 Cost and Operational Effectiveness Analysis for the Comanche to determine whether its conclusions were still valid.

DoD-wide Corporate Level Government Performance and Results Act Goals. In response to the Government Performance and Results Act, the Department of Defense has established 6 DoD-wide corporate level performance objectives and 14 goals for meeting these objectives This report pertains to achievement of the following objective and goal

> **Objective:** Prepare now for an uncertain future **Goal:** Pursue a focused modernization effort that maintains U.S qualitative superiority in key war-fighting capabilities (DoD-3)

DoD Functional Area Reform Goals. Most major functional areas have also established performance improvement reform objectives and goals This report pertains to achievement of the following functional area objectives and goals.

> **Acquisition Functional Area.**
>
> **Objective:** Deliver great service **Goal:** Deliver new major defense systems to the users in 25 percent less time. **(ACQ-1.1)**
>
> **Objective:** Internal reinvention **Goal:** Minimize cost growth in major defense acquisition programs to no greater than 1 percent annually **(ACQ-3.4)**

General Accounting Office High-Risk Area. The General Accounting Office has identified several high-risk areas in the Department of Defense. This report provides coverage of the Defense Weapons Systems Acquisition high-risk area

Methodology

Use of Computer-Processed Data. We did not use computer-processed data to perform this audit.

Use of Technical Assistance. We were assisted by an aerospace engineer from our Technical Assessment Division

Audit Period and Standards. We performed this economy and efficiency audit from December 1996 through July 1998, in accordance with auditing standards issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD.

Contacts During the Audit. We visited or contacted individuals and organizations within DoD and the Boeing Sikorsky RAH-66 Comanche Team, Philadelphia, Pennsylvania Further details are available upon request

Management Control Program Review

DoD Directive 5010 38, "Management Control (MC) Program," August 26, 1996, requires DoD organizations to implement a comprehensive system of management controls that provides reasonable assurance that programs are operating as intended and to evaluate the adequacy of the controls

Scope of Review of Management Control Program. In accordance with DoD Regulation 5000.1 "Defense Acquisition," March 15, 1996, and DoD Regulation 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs," March 15, 1996, acquisition managers are to use program cost, schedule, and performance parameters as control objectives to implement the requirements of DoD Directive 5010.38. Accordingly, we limited our review to management controls directly related to acquisition management.

Adequacy of Management Controls. The acquisition strategy selected by the Army was flawed and did not give sufficient priority to the development and integration of the fire control radar The Program Manager's corrective action plan, when implemented, will provide for a more appropriate and cost-effective acquisition strategy and the appropriate priority for the development and integration of the fire control radar. We will provide a copy of our report to the senior official responsible for management controls in the Army

Adequacy of the Comanche Program Office Self-Evaluation. The Comanche Program Office did not identify the acquisition strategy, the fire control radar, or the analysis of alternatives as part of its assessable units In addition, although the Program Manager agreed with the three findings in this report, he did not agree that they constituted management control weaknesses.

Summary of Prior Audits

During the last 5 years, two final audit reports and one draft audit report involved the Comanche Program

General Accounting Office (GAO/NSIAD) Audit No 95-112 (OSD Case No. 9877), "Comanche Helicopter - Testing Needs to be Completed Prior to Product Decisions," May 1995.

Inspector General, DoD, Report No.98-185, "Financial Management of the RAH-66 Comanche Helicopter Program," August 6, 1998.

Inspector General, DoD, Report No 98-125, "Protection of the Comanche Helicopter Against Radio Frequency Weapons," April 28, 1998

Appendix B. Report Distribution

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition and Technology
  Director, Defense Logistics Studies Information Exchange
  Director, Strategic and Tactical Systems
Under Secretary of Defense (Comptroller)
  Deputy Comptroller (Program/Budget)
  Deputy Chief Financial Officer
  Director, Program Analysis and Evaluation
Assistant Secretary of Defense (Public Affairs)

Department of the Army

Assistant Secretary of the Army (Financial Management and Comptroller)
Assistant Secretary of the Army (Research, Development, and Acquisition)
Commander, Training and Doctrine Command
Commander, U S. Army Aviation and Missile Command
Program Executive Officer for Aviation
  Program Manager for the Comanche Program
Auditor General, Department of the Army

Department of the Navy

Assistant Secretary of the Navy (Financial Management and Comptroller)
Auditor General, Department of the Navy

Department of the Air Force

Assistant Secretary of the Air Force (Financial Management and Comptroller)
Auditor General, Department of the Air Force

Other Defense Organizations

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Other Defense Organizations (cont'd)

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Inspector General, National Security Agency
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Office of Management and Budget
Technical Information Center, National Security and International Affairs Division, General Accounting Office

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Senate Committee on Appropriations
Senate Subcommittee on Defense, Committee on Appropriations
Senate Committee on Armed Services
Senate Committee on Governmental Affairs
House Committee on Appropriations
House Subcommittee on National Security, Committee on Appropriations
House Committee on Government Reform and Oversight
House Subcommittee on Government Management Information and Technology, Committee on Government Reform and Oversight
House Subcommittee on National Security, International Affairs, and Criminal Justice, Committee on Government Reform and Oversight
House Committee on National Security

Part III - Management Comments

Department of the Army Comments

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
RESEARCH DEVELOPMENT AND ACQUISITION
103 ARMY PENTAGON
WASHINGTON DC 20310-0103

REPLY TO
ATTENTION OF

16 SEP 1998

SARD-SA (36-2B)

MEMORANDUM THRU U.S. ARMY AUDIT AGENCY, ATTN: SAAG-PMO-L, 3101 PARK CENTER DRIVE, ALEXANDRIA, VIRGINIA 22302-1596

FOR INSPECTOR GENERAL, DEPARTMENT OF DEFENSE, 400 ARMY NAVY DRIVE, ARLINGTON, VIRGINIA, 22202-2884

SUBJECT: Audit Report on Acquisition Management of the Comanche Program (Project No. 7AL-0012.02)

1. References:

a. U.S. Army Audit Agency Memorandum, 30 July 1998, SAB.

b. Department of Defense Inspector General Memorandum, 28 July 1998, SAB.

2. This memorandum responds to your request for comments on the draft report. The enclosed response was prepared by the Program Manager, Comanche and has been coordinated with the Audit Project Manager.

3. As indicated in the Program Manager's response, the transition from the Early Operational Capability (EOC) program to the Pre-Production Program (PPP) should resolve the major findings in this audit report. It should be noted that the Army had previously recognized the desirability of revising the program prior to the DoDIG review. The Program Manager had already initiated a transition from the EOC program to the PPP program to take advantage of advancements in radar technology and to structure the program as efficiently as possible.

4. Point of contact for this action is Mrs. Alice Hartman, (703) 604-7054.

PETER C. FRANKLIN
Major General, GS
Deputy for Systems Management and
Horizontal Technology Integration

Encl

DEPARTMENT OF THE ARMY
UNITED STATES ARMY AVIATION AND MISSILE COMMAND
REDSTONE ARSENAL, ALABAMA 35898-5000

REPLY TO ATTENTION OF

AMSAM-IR

31 Aug 98

MEMORANDUM FOR Inspector General, Department of Defense,
400 Army Navy Drive,
ATTN: Mr. William D. Van Hoose,
Arlington, VA 22202

SUBJECT: DODIG Draft Report, Acquisition Management of the Comanche Program (Project No. 7AL-0012.02) (AMCOM 04-1096-493)

1. Enclosed are comments to the subject draft report from the Aviation Program Executive Office.

2. Point of contact for this action is Mr. William R. Huseman, AMSAM-IR, DSN 897-1785 or commercial 256-313-1785.

Ellis L. Cox

Encl

ELLIS L. COX
Chief, Internal Review and
Audit Compliance Office

CF:

Army Audit Control Point
(Ms. Deborah Rinderknecht)

AN EQUAL OPPORTUNITY EMPLOYER

DEPARTMENT OF THE ARMY
OFFICE OF THE PROGRAM EXECUTIVE OFFICER, AVIATION
REDSTONE ARSENAL, AL 35898-5000

REPLY TO
ATTENTION OF

27 AUG 1998

SFAE-AV-P

MEMORANDUM FOR Chief, Internal Review and Compliance Office,
ATTN: AMSAM-IR

SUBJECT: DODIG Draft Report, Acquisition Management of the Comanche Program (Project No. 7AL-0012.02)

1. Reference memorandum, AMSAM-IR, 27 Jul 98, subject as above.

2. Enclosed is the response from the Comanche Program Manager's Office.

3. Point of contact in the Program Executive Office, Aviation, is Dianne Atchley, DSN 897-4207 or Commercial 256-313-4027. Point of contact in the Comanche Program Office is Sally Ramey, DSN 897-4321 or Commercial 256-313-4321.

Paul Bogosian

PAUL BOGOSIAN
Deputy Program Executive, Aviation

Encl

DEPARTMENT OF THE ARMY
PROGRAM MANAGER, COMANCHE
BLDG. 5681, REDSTONE ARSENAL, AL 35898-5010

REPLY TO ATTENTION OF

SFAE-AV-RAH

AUG 1 8 1998

MEMORANDUM FOR Inspector General, Department of Defense
400 Army/Navy Drive (Room 801)
Arlington, Virginia 22202-2884

SUBJECT: Audit Report on Acquisition Management of the Comanche Program
(Project No 7AL-0012.02)

1. Reference your memorandum, 28 Jul 98, subject as above.

2. Response to DoDIG Draft Audit Report. Recommendations are as follows:

Finding A: Acquisition Strategy

General comments—

The Comanche Program Office's acquisition strategy may not provide enough prototypes or flight hours for developmental testing; will not provide for determining the operational effectiveness and suitability of the Comanche helicopter; and will not provide for developing tactics, techniques, and procedures. These conditions occurred because the Comanche Program Office had not developed a rigorous analysis of the advantages and disadvantages of the acquisition strategy. As a result, the Comanche Program could be further delayed and incur additional cost.

Response—

The Army shared some of the same concerns addressed by this finding and had already been in the process of transitioning the Comanche program from the Early Operational Capability to the Pre-Production Program plan. These changes address each of the stated concerns with the current program plan. The EOC program resulted from the Dec 94 restructure of the Comanche program and was based more on availability of resources than on the best approach to develope the Comanche Since that time, the Army has continued to make improvements to the EOC program plan as resources are available. The most significant event that has enabled a transition to a new plan is the recent advancements in radar technology By taking advantage of accelerated development of radar capabilities and a projected reduced cost to incorporate the radar into the Comanche, the entire Comanche development program has been greatly improved. The

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SUBJECT: Audit Report on Acquisition Management of the Comanche Program (Project No. 7AL-0012.02)

radar will now be available with the initial fielding of the Comanche in Dec 2006 and the areas of the program that were dedicated to fielding an interim configuration have been changed to fully support the development of the production representative configuration. As suggested, the EOC aircraft, which were being built in an interim configuration, have been deleted from the plan and are now planned for delivery approximately 14 months later in the production configuration. The later delivery of those aircraft allow the completion of design of both the reconnaissance and the armament MEP, needed to support the production configuration. In addition, we will be able to accelerate the availability of additional simulators/trainers with full functionality for the user to develop tactics, techniques and procedures that will be representative of the mission capability of the Comanche when fielded in Dec 2006 A further advantage of the Pre-Production Program plan is the increase in the number of test aircraft from 2 to 6 which results in over 3700 flight hours being dedicated to development flight test The IOTE planned in FY2009 for the Comanche equipped with the fire control radar can now be accomplished as part of a single IOTE in FY2006, thus saving significant resources and providing the full mission capable Comanche concurrent with the initial fielding in Dec 2006. In summary, the transition from the EOC program plan to the Pre-Production Program plan is believed to be the answer to each of the concerns addressed in this finding. The Pre-Production Program plan has been approved by the Army and OSD with a subsequent OIPT review to include CAIG and CEAC costs scheduled for Dec 98, which would recommend approval and release of the Acquisition Decision Memorandum implementing the program.

The milestones associated with the final approval of the Pre-Production Program plan include:

Sep 98 - Submittal of an updated Acquisition Strategy Report, Acquisition Program Baseline and TEMP
Oct 98 - Initial review of the cost review by the CAIG/CEAC
Dec 98 - OIPT evaluation of the cost review results prior to recommendation of DAE approval of the PPP plan

Target Date-- Implementation of the recommended changes is Dec 98.

Finding B: Fire Control Radar

General comments—

The Comanche Program Office plans to delay the development of a fire control radar (FCR) for the Comanche until 2004. This condition occurred because the Comanche Program Office assigned a higher priority to other tasks, which then received the available funds. As a result, integrating an FCR into the production configuration of the

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Comanche could require a major redesign that could be unaffordable, further resulting in a Comanche without a FCR, which would be less effective than the Apache with a FCR.

Response—

On 27 July, the Comanche Program received approval from the Defense Acquisition Executive, Dr. Gansler, to restructure the existing program. A key element of the program change is to accelerate development, integration and testing of the fire control radar to match the current development plan for the basic aircraft. In accordance with the new program plan, the fire control radar will be fielded on the production aircraft at Initial Operating Capability (IOC) in December 2006. This change should completely resolve the concern expressed in the finding.

Target Date-- Implementation of the recommended changes has begun.

Finding C:

General—

The 1991 Cost and Operational Effectiveness Analysis (COEA) for the Comanche helicopter is no longer valid because of changes to the procurement quantities, costs, threats, capabilities, and alternatives for the Comanche helicopter since it was prepared. As a result, the Army needs to revalidate that it is developing the best alternative for the Army attack and reconnaissance helicopter missions.

Response—

The 1991 Cost and Operational Analysis (COEA) was performed to support the MS I decision. An update to the COEA/Analysis of Alternatives (AOA) is a MS II requirement. The Comanche Program office will update the AOA with current information and alternatives to support the MS II. This updated AOA will address factors such as procurement quantities, costs, threats, and capabilities as suggested.

Target Date-- Currently implementing the planning activities for AOA in support of MS II

Management Controls:

The Comanche Program Manager's Office believes it does, in fact, have adequate management controls and had already begun to correct the issues identified by the DoDIG prior to the audit.

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SUBJECT: Audit Report on Acquisition Management of the Comanche Program (Project No. 7AL-0012.02)

3. Point of contact for Finding A is Mr. Billy Miller, DSN 897-4562 or (256) 313-4562; POC for Findings B and C is Mr. Mike Richey, DSN 897-4508 or (256) 313-4508; POC for Management Controls is Ms. Sally Ramey, DSN 897-4321 or (256) 313-4321.

Joseph L. Bergantz

JOSEPH L. BERGANTZ
Brigadier General, U.S. Army
Program Manager
Comanche Program

4

Audit Team Members

The Acquisition Management Directorate, Office of the Assistant Inspector General for Auditing, DoD, produced this report

Thomas F. Gimble
Patricia A. Brannin
Charles M Santoni
William D Van Hoose
Ramon Garcia
James A. Hoyt
Dency M. Welborn
Ursula Cleary
Averel A. Gregg
Patricia A. Joyner
Krista S Gordon

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Inspector General, Department of Defense
400 Army Navy Drive (Room 801)
Arlington, VA 22202-2884

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